
Name of Organization: USGS

Type of Organization: Federally-funded R & D Center

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Project Title: Sex ratio determination and contaminant content in a mussel

Project Category: Emerging Issues

Rank by Organization (if applicable): 0

Total Funding Requested (\$): 160,000 **Project Duration:** 2 Years

Abstract:

Sex ratio determination and contaminant content in a mussel community of national concern.

This study will quantify contaminant concentrations in native mussels (Family: Unionidae) to determine if they may be contributing to the decline of the unionid community in Fish Creek, Indiana. Fish Creek contains federal- and state-listed threatened and endangered species, including *Villosa fabilis* and *Epioblasma obliquata perobliqua*. Recent evidence suggests that mussels may be facing environmental stress that may be skewing the sex ratio, thus forcing these populations into extinction. The source of this stress is speculative and immediate research is warranted. However, most feasible studies on these listed species would require destructive sampling. We propose to use surrogate species to investigate a potential environmental stress affecting mussels in Fish Creek.

Fish Creek is located in an agriculturally-dominated landscape. One of its branches flows through the City of Hamilton, IN, where it receives discharge from the Hamilton Wastewater Treatment Plant. In 1995, a large diesel spill occurred in the central part of Fish Creek, just above the suspected habitat of the white cat's paw (Jim Smith, Indiana Department of Environmental Management, personal communication). These impacts make measurement of the contaminants associated with these activities imperative. Recent interest in endocrine-disrupting chemicals (EDCs) has developed. These may pose a threat to mollusk populations, especially the imperiled freshwater bivalves.

Geographic Areas Affected by the Project

States:

<input type="checkbox"/> Illinois	<input type="checkbox"/> New York
<input checked="" type="checkbox"/> Indiana	<input type="checkbox"/> Pennsylvania
<input checked="" type="checkbox"/> Michigan	<input type="checkbox"/> Wisconsin
<input type="checkbox"/> Minnesota	<input checked="" type="checkbox"/> Ohio

Lakes:

<input type="checkbox"/> Superior	<input checked="" type="checkbox"/> Erie
<input type="checkbox"/> Huron	<input type="checkbox"/> Ontario
<input type="checkbox"/> Michigan	<input type="checkbox"/> All Lakes

Geographic Initiatives:

<input type="checkbox"/> Greater Chicago	<input type="checkbox"/> NE Ohio	<input type="checkbox"/> NW Indiana	<input type="checkbox"/> SE Michigan	<input type="checkbox"/> Lake St. Clair
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Primary Affected Area of Concern: Maumee River, OH

Other Affected Areas of Concern:

For Habitat Projects Only:

Primary Affected Biodiversity Investment Area: Not Applicable

Other Affected Biodiversity Investment Areas:

Problem Statement:

Mussels of the families Margaritiferidae and Unionidae are distributed worldwide, but the greatest diversity is found in eastern North America (Williams et al. 1993). Of the 281 species in North America, 75% are considered extinct, endangered, threatened, or of special concern and are the most rapidly declining animal group in the US (Master 1990, The Nature Conservancy 1996, Karr and Chu 1999). Erosion, siltation, sedimentation, channelization, and contamination have been implicated as reducing the number and diversity of freshwater mollusks (Fuller 1974, Marking and Bills 1980, Havlik and Marking 1987).

Fish Creek is the last known location of the white cat's paw pearly mussel, *Epioblasma obliquata perobliqua* (US FWS 1988), a state and federally listed endangered mussel species (IDNR 1990). Other rare and endangered species have been confirmed from Fish Creek, including the rayed bean (*Villosa fabilis*) and salamander mussel (*Simpsonia ambigua*) (Stewart and Swinford 1995). Since the 1980s, two male white cat's paw pearly mussel were found in Fish Creek (B. Fisher, IDNR, Pers. Comm.). We hypothesize that contaminants may be affecting unionid populations. Endocrine-disrupting chemicals (EDCs) may be influencing the sex ratio in *E. obliquata perobliqua*, and these EDCs may be affecting other mussel species, including *V. fabilis*.

The objectives of this project are to examine sex ratios among resident Fish Creek mussel populations and determine the concentration of contaminants in mussel tissue and sediments. We propose to use non-listed species, reasoning that other mussels will be affected by these chemicals in a similar manner. Specific objectives include:

- 1) Non-destructively record the sex ratio of unionid mussel species occurring in Fish Creek
- 2) Use surrogate species for *Villosa fabilis* and *Epioblasma obliquata perobliqua* to measure tissue contaminant concentrations
- 3) Measure sediment contaminant content at selected sites
- 4) Measure endocrine disruptor content in a limited number of unionid tissue samples at a selected site

Hypothesis: Unionid mussel sex ratios, although plastic, typically display a nearly even sex ratio in pristine environments (Richard Neves, Virginia Tech, January 5, 2000, personal communication). Contaminants may degrade the health of unionid populations. These contaminants can include pesticides, heavy metals, PCBs, PAHs, and endocrine disruptors. Endocrine-disrupting chemicals (EDCs) are of national concern because they pose a threat to mollusk populations, especially the imperiled freshwater bivalves. These are derived from a number of chemicals that can mimic hormones in enzyme systems. Endocrine disruptor chemicals may effect unionid sex ratios by causing demasculization and feminization of an individual or population. If endocrine disruptor chemicals are affecting populations, then skewed sex ratios may be found; these findings should coincide with increased concentrations of EDCs in mussel tissues and sediments.

Proposed Work Outcome:

A written report (peer-reviewed publication) on the status of sex ratios of unionid populations in Fish Creek and the presence of tissue contaminants including endocrine disruptors will be generated by this project. Results from this study will be useful to local management (The Nature Conservancy, Indiana Department of Natural Resources, Indiana Department of Environmental Management, U.S. Fish and Wildlife Service) in their efforts to save and improve mussel populations in Fish Creek. This work is be useful to the U.S. EPA because of their interest in endangered species, and as part of the Fish Creek Recovery efforts.

Project Milestones:**Dates:**

Project Start	07/2000
Samples Collected	08/2000
Samples analyzed	09/2000
Samples collected	06/2001
Samples analyzed	07/2001
Draft report	09/2001
Final report	11/2001
Project End	12/2001

☐ Project Addresses Environmental Justice

If So, Description of How:

☐ Project Addresses Education/Outreach

If So, Description of How:

Project Budget:

	Federal Share Requested (\$)	Applicant's Share (\$)
Personnel:	57,000	30,000
Fringe:	10,000	10,000
Travel:	5,000	2,000
Equipment:	5,000	2,000
Supplies:	5,000	2,000
Contracts:	45,000	0
Construction:	0	0
Other:	0	0
Total Direct Costs:	127,000	46,000
Indirect Costs:	33,000	0
Total:	160,000	46,000
Projected Income:	0	0

Funding by Other Organizations (Names, Amounts, Description of Commitments):

Partnering with:

U.S. Fish & Wildlife Service

Indiana Department of Environmental Management

Indiana Department of Natural Resources

Description of Collaboration/Community Based Support:

U.S. Fish & Wildlife Service, Bloomington Field office, Trustee

Indiana Department of Environmental Management, Trustee

Indiana Division of Natural Resources, Trustee